PRACTICE EXERCISES

Part A. Directions: Answer these questions *without* using your calculator.

In each of Questions 1–20 a function is given. Choose the alternative that is the derivative, $\frac{dy}{dx}$, of the function.

1. $y = x^5 \tan x$
   (A) $5x^4 \tan x$ (B) $x^5 \sec^2 x$ (C) $5x^4 \sec^2 x$
   (D) $5x^4 + \sec^2 x$ (E) $5x^4 \tan x + x^5 \sec^2 x$

2. $y = \frac{2-x}{3x+1}$
   (A) $-\frac{7}{(3x+1)^2}$ (B) $\frac{6x-5}{(3x+1)^2}$ (C) $-\frac{9}{(3x+1)^2}$ (D) $\frac{7}{(3x+1)^2}$ (E) $\frac{7-6x}{(3x+1)^2}$

3. $y = \sqrt{3-2x}$
   (A) $\frac{1}{2\sqrt{3-2x}}$ (B) $-\frac{1}{\sqrt{3-2x}}$ (C) $-\frac{(3-2x)^{3/2}}{3}$
   (D) $-\frac{1}{3-2x}$ (E) $\frac{2}{3}(3-2x)^{3/2}$

4. $y = \frac{2}{(5x+1)^3}$
   (A) $-\frac{30}{(5x+1)^2}$ (B) $-30(5x+1)^{-4}$ (C) $\frac{-6}{(5x+1)^4}$
   (D) $-\frac{10}{3}(5x+1)^{-4/3}$ (E) $\frac{30}{(5x+1)^4}$

5. $y = 3x^{2/3} - 4x^{1/2} - 2$
   (A) $2x^{1/3} - 2x^{-1/2}$ (B) $3x^{-1/3} - 2x^{-1/2}$ (C) $\frac{9}{5}x^{5/3} - 8x^{3/2}$
   (D) $\frac{2}{x^{1/3}} - \frac{2}{x^{1/2}} - 2$ (E) $2x^{-1/3} - 2x^{-1/2}$

6. $y = 2\sqrt{x} - \frac{1}{2\sqrt{x}}$
   (A) $x + \frac{1}{x\sqrt{x}}$ (B) $x^{-1/2} + x^{-3/2}$ (C) $\frac{4x-1}{4x\sqrt{x}}$ (D) $\frac{1}{\sqrt{x}} + \frac{1}{4x\sqrt{x}}$ (E) $\frac{4}{\sqrt{x}} + \frac{1}{x\sqrt{x}}$

7. $y = \sqrt{x^2 + 2x - 1}$
   (A) $\frac{x+1}{y}$ (B) $4y(x+1)$ (C) $\frac{1}{2\sqrt{x^2+2x-1}}$
   (D) $-\frac{x+1}{(x^2+2x-1)^{3/2}}$ (E) none of these

8. $y = \frac{x^2}{\cos x}$
   (A) $\frac{2x}{\sin x}$ (B) $-\frac{2x}{\sin x}$ (C) $\frac{2x \cos x - x^2 \sin x}{\cos^2 x}$
   (D) $\frac{2x \cos x + x^2 \sin x}{\cos^2 x}$ (E) $\frac{2x \cos x + x^2 \sin x}{\sin^2 x}$

9. $y = \ln \frac{e^x}{e^x - 1}$

(A) $x - \frac{e^x}{e^x - 1}$ (B) $\frac{1}{e^x - 1}$ (C) $-\frac{1}{e^x - 1}$ (D) 0 (E) $\frac{e^x - 2}{e^x - 1}$

10. $y = \tan^{-1} \frac{x}{2}$

(A) $\frac{4}{4 + x^2}$ (B) $\frac{1}{2\sqrt{4 - x^2}}$ (C) $\frac{2}{\sqrt{4 - x^2}}$ (D) $\frac{1}{2 + x^2}$ (E) $\frac{2}{x^2 + 4}$

11. $y = \ln(\sec x + \tan x)$

(A) $\sec x$ (B) $\frac{1}{\sec x}$ (C) $\tan x + \frac{\sec^2 x}{\tan x}$

(D) $\frac{1}{\sec x + \tan x}$ (E) $-\frac{1}{\sec x + \tan x}$

12. $y = \frac{e^x - e^{-x}}{e^x + e^{-x}}$

(A) 0 (B) 1 (C) $\frac{2}{(e^x + e^{-x})^2}$ (D) $\frac{4}{(e^x + e^{-x})^2}$ (E) $\frac{1}{e^{2x} + e^{-2x}}$

13. $y = \ln\left(\sqrt{x^2 + 1}\right)$

(A) $\frac{1}{\sqrt{x^2 + 1}}$ (B) $\frac{2x}{\sqrt{x^2 + 1}}$ (C) $\frac{1}{2(x^2 + 1)}$ (D) $\frac{x}{x^2 + 1}$ (E) $\frac{2x}{x^2 + 1}$

14. $y = \sin\left(\frac{1}{x}\right)$

(A) $\cos\left(\frac{1}{x}\right)$ (B) $\cos\left(-\frac{1}{x^2}\right)$ (C) $-\frac{1}{x^2}\cos\left(\frac{1}{x}\right)$

(D) $-\frac{1}{x^2}\sin\left(\frac{1}{x}\right) + \frac{1}{x}\cos\left(\frac{1}{x}\right)$ (E) $\cos(\ln x)$

15. $y = \frac{1}{2 \sin 2x}$

(A) $-\csc 2x \cot 2x$ (B) $\frac{1}{4 \cos 2x}$ (C) $-4 \csc 2x \cot 2x$

(D) $\frac{\cos 2x}{2\sqrt{\sin 2x}}$ (E) $-\csc^2 2x$

16. $y = e^{-x} \cos 2x$

(A) $-e^{-x}(\cos 2x + 2 \sin 2x)$

(B) $e^{-x}(\sin 2x - \cos 2x)$

(C) $2e^{-x} \sin 2x$

(D) $-e^{-x}(\cos 2x + \sin 2x)$

(E) $-e^{-x} \sin 2x$

17. $y = \sec^2(x)$

(A) $2 \sec x$ (B) $2 \sec x \tan x$ (C) $2 \sec^2 x \tan x$

(D) $\sec^2 x \tan^2 x$ (E) $\tan x$

18. $y = x \ln^3 x$

(A) $\frac{3 \ln^2 x}{x}$ (B) $3 \ln^2 x$ (C) $3x \ln^2 x + \ln^3 x$

(D) $3(\ln x + 1)$ (E) none of these

19. $y = \frac{1+x^2}{1-x^2}$

(A) $-\frac{4x}{(1-x^2)^2}$ (B) $\frac{4x}{(1-x^2)^2}$ (C) $-\frac{4x^3}{(1-x^2)^2}$ (D) $\frac{2x}{1-x^2}$ (E) $\frac{4}{1-x^2}$

20. $y = \sin^{-1} x - \sqrt{1-x^2}$

(A) $\frac{1}{2\sqrt{1-x^2}}$ (B) $\frac{2}{\sqrt{1-x^2}}$ (C) $\frac{1+x}{\sqrt{1-x^2}}$ (D) $\frac{x^2}{\sqrt{1-x^2}}$ (E) $\frac{1}{\sqrt{1+x}}$

In each of Questions 21–24, y is a differentiable function of x. Choose the alternative that is the derivative $\frac{dy}{dx}$.

21. $x^3 - y^3 = 1$

(A) x (B) $3x^2$ (C) $\sqrt[3]{3x^2}$ (D) $\frac{x^2}{y^2}$ (E) $\frac{3x^2-1}{y^2}$

22. $x + \cos(x+y) = 0$

(A) $\csc(x+y) - 1$ (B) $\csc(x+y)$ (C) $\frac{x}{\sin(x+y)}$

(D) $\frac{1}{\sqrt{1-x^2}}$ (E) $\frac{1-\sin x}{\sin y}$

23. $\sin x - \cos y - 2 = 0$

(A) $-\cot x$ (B) $-\cot y$ (C) $\frac{\cos x}{\sin y}$

(D) $-\csc y \cos x$ (E) $\frac{2-\cos x}{\sin y}$

24. $3x^2 - 2xy + 5y^2 = 1$

(A) $\frac{3x+y}{x-5y}$ (B) $\frac{y-3x}{5y-x}$ (C) $3x+5y$ (D) $\frac{3x+4y}{x}$ (E) none of these

BC ONLY

25. If $x = t^2 + 1$ and $y = 2t^3$, then $\frac{dy}{dx} =$

(A) $3t$ (B) $6t^2$ (C) $\frac{6t^2}{t^2+1}$ (D) $\frac{6t^2}{(t^2+1)^2}$ (E) $\frac{2t^4+6t^2}{(t^2+1)^2}$

26. If $f(x) = x^4 - 4x^3 + 4x^2 - 1$, then the set of values of x for which the derivative equals zero is

(A) $\{1, 2\}$ (B) $\{0, -1, -2\}$ (C) $\{-1, +2\}$ (D) $\{0\}$ (E) $\{0, 1, 2\}$

27. If $f(x) = 16\sqrt{x}$, then $f'''(4)$ is equal to

(A) -32 (B) -16 (C) -4 (D) -2 (E) $-\frac{1}{2}$

28. If $f(x) = \ln x^3$, then $f''(3)$ is

(A) $-\frac{1}{3}$ (B) -1 (C) -3 (D) 1 (E) 3

29. If a point moves on the curve $x^2 + y^2 = 25$, then, at $(0, 5)$, $\frac{d^2y}{dx^2}$ is

(A) 0 (B) $\frac{1}{5}$ (C) -5 (D) $-\frac{1}{5}$ (E) nonexistent

BC ONLY

30. If $x = t^2 - 1$ and $y = t^4 - 2t^3$, then, when $t = 1$, $\frac{d^2y}{dx^2}$ is

(A) 1 (B) -1 (C) 0 (D) 3 (E) $\frac{1}{2}$

31. If $f(x) = 5^x$ and $5^{1.002} \approx 5.016$, which is closest to $f'(1)$?

(A) 0.016 (B) 1.0 (C) 5.0 (D) 8.0 (E) 32.0

32. If $y = e^x(x - 1)$, then $y''(0)$ equals

(A) -2 (B) -1 (C) 0 (D) 1 (E) e

BC ONLY

33. If $x = e^\theta \cos\theta$ and $y = e^\theta \sin\theta$, then, when $\theta = \frac{\pi}{2}$, $\frac{dy}{dx}$ is

(A) 1 (B) 0 (C) $e^{\pi/2}$ (D) nonexistent (E) -1

34. If $x = \cos t$ and $y = \cos 2t$, then $\frac{d^2y}{dx^2}$ ($\sin t \neq 0$) is

(A) $4\cos t$ (B) 4 (C) $\frac{4y}{x}$ (D) -4 (E) $-4\cot t$

35. $\lim\limits_{h\to 0} \frac{(1+h)^6 - 1}{h}$ is

(A) 0 (B) 1 (C) 6 (D) ∞ (E) nonexistent

36. $\lim\limits_{h\to 0} \frac{\sqrt[3]{8+h} - 2}{h}$ is

(A) 0 (B) $\frac{1}{12}$ (C) 1 (D) 192 (E) ∞

37. $\lim\limits_{h\to 0} \frac{\ln(e+h) - 1}{h}$ is

(A) 0 (B) $\frac{1}{e}$ (C) 1 (D) e (E) nonexistent

38. $\lim\limits_{x\to 0} \frac{\cos x - 1}{x}$ is

(A) $-\infty$ (B) -1 (C) 0 (D) 1 (E) ∞

39. If $f(x) = \begin{cases} \frac{4x^2-4}{x-1}, & x \neq 1 \\ 4, & x = 1 \end{cases}$, which of these statements are true?

I. $\lim\limits_{x\to 1} f(x)$ exists.
II. f is continuous at $x = 1$.
III. f is differentiable at $x = 1$.

(A) none (B) I only (C) I and II only (D) I and III only (E) I, II, and III

40. If $g(x) = \begin{cases} x^2, & x \leq 3 \\ 6x - 9, & x > 3 \end{cases}$, which of these statements are true?

I. $\lim\limits_{x\to 3} g(x)$ exists.
II. g is continuous at $x = 3$.
III. g is differentiable at $x = 3$.

(A) I only (B) II only (C) III only (D) I and II only (E) I, II, and III

41. The function $f(x) = x^{2/3}$ on $[-8, 8]$ does not satisfy the conditions of the Mean Value Theorem because

(A) $f(0)$ is not defined
(B) $f(x)$ is not continuous on $[-8, 8]$
(C) $f'(-1)$ does not exist
(D) $f(x)$ is not defined for $x < 0$
(E) $f'(0)$ does not exist

42. If $f(x) = 2x^3 - 6x$, at what point on the interval $0 \leq x \leq \sqrt{3}$, if any, is the tangent to the curve parallel to the secant line on that interval?

(A) 1 (B) -1 (C) $\sqrt{2}$ (D) 0 (E) nowhere

43. If h is the inverse function of f and if $f(x) = \frac{1}{x}$, then $h'(3) =$

(A) -9 (B) $-\frac{1}{9}$ (C) $\frac{1}{9}$ (D) 3 (E) 9

44. $\lim\limits_{x\to\infty} \frac{e^x}{x^{50}}$ equals

(A) 0 (B) 1 (C) $\frac{1}{50!}$ (D) $\frac{e}{50!}$ (E) ∞

45. If $\sin(xy) = x$, then $\frac{dy}{dx} =$

(A) $\sec(xy)$ (B) $\frac{\sec(xy)}{x}$ (C) $\frac{\sec(xy) - y}{x}$
(D) $\frac{1 + \sec(xy)}{x}$ (E) $\sec(xy) - 1$

46. $\lim\limits_{x\to 0} \frac{\sin 2x}{x}$ is

(A) 1 (B) 2 (C) $\frac{1}{2}$ (D) 0 (E) ∞

47. $\lim\limits_{x\to 0} \frac{\sin 3x}{\sin 4x}$ is

(A) 1 (B) $\frac{4}{3}$ (C) $\frac{3}{4}$ (D) 0 (E) nonexistent

48. $\lim\limits_{x\to 0} \frac{1 - \cos x}{x}$ is

(A) $-\infty$ (B) 0 (C) 1 (D) 2 (E) ∞

49. $\lim\limits_{x\to 0} \frac{\tan \pi x}{x}$ is

(A) $\frac{1}{\pi}$ (B) 0 (C) 1 (D) π (E) ∞

50. $\lim\limits_{x\to\infty} x^2 \sin \frac{1}{x}$

(A) is 1 (B) is 0 (C) is ∞
(D) oscillates between -1 and 1 (E) is none of these

BC ONLY

51. The graph in the xy-plane represented by $x = 3 + 2 \sin t$ and $y = 2 \cos t - 1$, for $-\pi \leq t \leq \pi$, is
(A) a semicircle (B) a circle (C) an ellipse
(D) half of an ellipse (E) a hyperbola

52. $\lim_{x\to 0}\frac{\sec x - \cos x}{x^2}$

(A) $= 0$ (B) $= \frac{1}{2}$ (C) $= 1$ (D) $= 2$ (E) does not exist

BC ONLY

In each of Questions 53–56 a pair of equations that represent a curve parametrically is given. Choose the alternative that is the derivative $\frac{dy}{dx}$.

53. $x = t - \sin t$ and $y = 1 - \cos t$

(A) $\frac{\sin t}{1-\cos t}$ (B) $\frac{1-\cos t}{\sin t}$ (C) $\frac{\sin t}{\cos t - 1}$

(D) $\frac{1-x}{y}$ (E) $\frac{1-\cos t}{t-\sin t}$

BC ONLY

54. $x = \cos^3\theta$ and $y = \sin^3\theta$

(A) $\tan^3\theta$ (B) $-\cot\theta$ (C) $\cot\theta$ (D) $-\tan\theta$ (E) $-\tan^2\theta$

55. $x = 1 - e^{-t}$ and $y = t + e^{-t}$

(A) $\frac{e^{-t}}{1-e^{-t}}$ (B) $e^{-t} - 1$ (C) $e^t + 1$ (D) $e^t - e^{-2t}$ (E) $e^t - 1$

56. $x = \frac{1}{1-t}$ and $y = 1 - \ln(1-t)$ $(t < 1)$

(A) $\frac{1}{1-t}$ (B) $t - 1$ (C) $\frac{1}{x}$ (D) $\frac{(1-t)^2}{t}$ (E) $1 + \ln x$

Part B. Directions: Some of the following questions require the use of a graphing calculator.

In Questions 57–64, differentiable functions f and g have the values shown in the table.

x	f	f'	g	g'
0	2	1	5	−4
1	3	2	3	−3
2	5	3	1	−2
3	10	4	0	−1

57. If $A = f + 2g$, then $A'(3) =$

(A) −2 (B) 2 (C) 7 (D) 8 (E) 10

58. If $B = f \cdot g$, then $B'(2) =$

(A) −20 (B) −7 (C) −6 (D) −1 (E) 13

59. If $D = \frac{1}{g}$, then $D'(1) =$

(A) $-\frac{1}{2}$ (B) $-\frac{1}{3}$ (C) $-\frac{1}{9}$ (D) $\frac{1}{9}$ (E) $\frac{1}{3}$

60. If $H(x) = \sqrt{f(x)}$, then $H'(3) =$

(A) $\frac{1}{4}$ (B) $\frac{1}{2\sqrt{10}}$ (C) 2 (D) $\frac{2}{\sqrt{10}}$ (E) $4\sqrt{10}$

61. If $K(x) = \left(\frac{f}{g}\right)(x)$, then $K'(0) =$

(A) $\frac{-13}{25}$ (B) $-\frac{1}{4}$ (C) $\frac{13}{25}$ (D) $\frac{13}{16}$ (E) $\frac{22}{25}$

62. If $M(x) = f(g(x))$, then $M'(1) =$

(A) -12 (B) -6 (C) 4 (D) 6 (E) 12

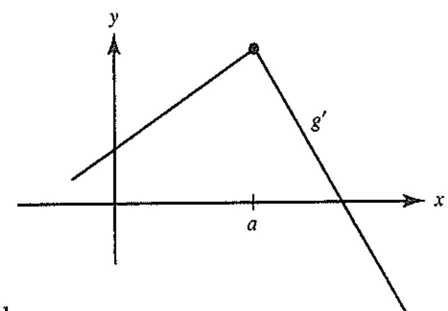
63. If $P(x) = f(x^3)$, then $P'(1) =$

(A) 2 (B) 6 (C) 8 (D) 12 (E) 54

64. If $S(x) = f^{-1}(x)$, then $S'(3) =$

(A) -2 (B) $-\frac{1}{25}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) 2

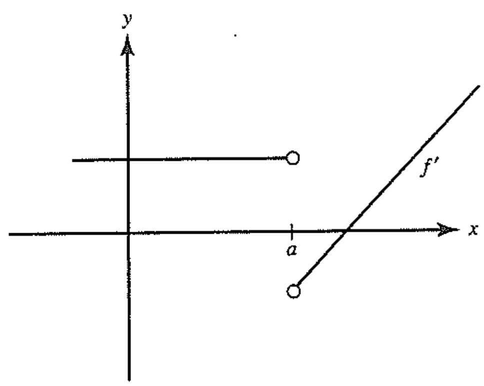
65. The graph of g' is shown here. Which of the following statements is (are) true of g?



I. g is continuous at $x = a$.
II. g is differentiable at $x = a$.
III. g is increasing in an interval containing $x = a$.

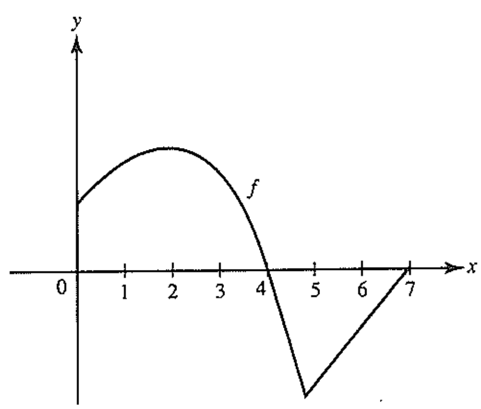
(A) I only (B) III only (C) I and III only
(D) II and III only (E) I, II, and III

66. A function f has the derivative shown. Which of the following statements must be false?



(A) f is continuous at $x = a$.
(B) $f(a) = 0$.
(C) f has a vertical asymptote at $x = a$.
(D) f has a jump discontinuity at $x = a$.
(E) f has a removable discontinuity at $x = a$.

67. The function f whose graph is shown has $f' = 0$ at $x =$



(A) 2 only
(B) 2 and 5
(C) 4 and 7
(D) 2, 4, and 7
(E) 2, 4, 5, and 7

PRACTICE EXERCISES

Part A. Directions: Answer these questions *without* using your calculator.

1. The slope of the curve $y^3 - xy^2 = 4$ at the point where $y = 2$ is

   (A) -2 (B) $\frac{1}{4}$ (C) $-\frac{1}{2}$ (D) $\frac{1}{2}$ (E) 2

2. The slope of the curve $y^2 - xy - 3x = 1$ at the point $(0, -1)$ is

   (A) -1 (B) -2 (C) $+1$ (D) 2 (E) -3

3. The equation of the tangent to the curve $y = x \sin x$ at the point $\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$ is

   (A) $y = x - \pi$ (B) $y = \frac{\pi}{2}$ (C) $y = \pi - x$

   (D) $y = x + \frac{\pi}{2}$ (E) $y = x$

4. The tangent to the curve of $y = xe^{-x}$ is horizontal when x is equal to

   (A) 0 (B) 1 (C) -1 (D) $\frac{1}{e}$ (E) e

5. The minimum value of the slope of the curve $y = x^5 + x^3 - 2x$ is

   (A) 0 (B) 2 (C) 6 (D) -2 (E) -6

6. The equation of the tangent to the hyperbola $x^2 - y^2 = 12$ at the point $(4, 2)$ on the curve is

   (A) $x - 2y + 6 = 0$ (B) $y = 2x$ (C) $y = 2x - 6$

   (D) $y = \frac{x}{2}$ (E) $x + 2y = 6$

7. The tangent to the curve $y^2 - xy + 9 = 0$ is vertical when

   (A) $y = 0$ (B) $y = \pm\sqrt{3}$ (C) $y = \frac{1}{2}$

   (D) $y = \pm 3$ (E) none of these

8. The best approximation, in cubic inches, to the increase in volume of a sphere when the radius is increased from 3 to 3.1 in. is

   (A) $\frac{0.04\pi}{3}$ (B) 0.04π (C) 1.2π (D) 3.6π (E) 36π

9. When $x = 3$, the equation $2x^2 - y^3 = 10$ has the solution $y = 2$. When $x = 3.04$, $y \approx$

   (A) 1.6 (B) 1.96 (C) 2.04 (D) 2.14 (E) 2.4

10. If the side e of a square is increased by 1%, then the area is increased approximately

    (A) $0.02e$ (B) $0.02e^2$ (C) $0.01e^2$ (D) 1% (E) $0.01e$

11. The edge of a cube has length 10 in., with a possible error of 1%. The possible error, in cubic inches, in the volume of the cube is

    (A) 1 (B) 3 (C) 10 (D) 30 (E) 100

20. The acceleration is positive

(A) when $t > 2$ (B) for all t, $t \neq 2$ (C) when $t < 2$
(D) for $1 < t < 3$ (E) for $1 < t < 2$

21. The speed of the particle is decreasing for

(A) $t < 2$ (B) $t < 3$ (C) all t
(D) $t < 1$ or $t > 2$ (E) $t > 2$

In Questions 22–24, a particle moves along a horizontal line and its position at time t is $s = t^4 - 6t^3 + 12t^2 + 3$.

22. The particle is at rest when t is equal to

(A) 1 or 2 (B) 0 (C) $\frac{9}{4}$ (D) 0, 1, or 2 (E) 0, 2, or 3

23. The velocity, v, is increasing when

(A) $t > 1$ (B) $1 < t < 2$ (C) $t < 2$
(D) $t < 1$ or $t > 2$ (E) $t > 0$

24. The speed of the particle is increasing for

(A) $0 < t < 1$ or $t > 2$ (B) $1 < t < 2$ (C) $t < 2$
(D) $t < 0$ or $t > 2$ (E) $t < 0$

25. The displacement from the origin of a particle moving on a line is given by $s = t^4 - 4t^3$. The maximum displacement during the time interval $-2 \leqq t \leqq 4$ is

(A) 27 (B) 3 (C) $12\sqrt{3} + 3$
(D) 48 (E) 16

26. If a particle moves along a line according to the law $s = t^5 + 5t^4$, then the number of times it reverses direction is

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

BC ONLY

In Questions 27–30, $\mathbf{R} = \left\langle 3\cos\frac{\pi}{3}t, 2\sin\frac{\pi}{3}t \right\rangle$ is the (position) vector $\langle x, y \rangle$ from the origin to a moving point $P(x, y)$ at time t.

27. A single equation in x and y for the path of the point is

(A) $x^2 + y^2 = 13$ (B) $9x^2 + 4y^2 = 36$ (C) $2x^2 + 3y^2 = 13$
(D) $4x^2 + 9y^2 = 1$ (E) $4x^2 + 9y^2 = 36$

28. When $t = 3$, the speed of the particle is

(A) $\frac{2\pi}{3}$ (B) 2 (C) 3 (D) π (E) $\frac{\sqrt{13}}{3}\pi$

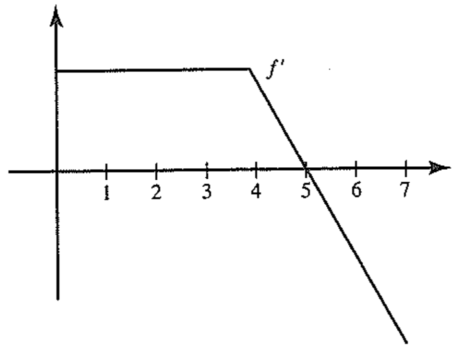
29. The magnitude of the acceleration when $t = 3$ is

(A) 2 (B) $\frac{\pi^2}{3}$ (C) 3 (D) $\frac{2\pi^2}{9}$ (E) π

30. At the point where $t = \frac{1}{2}$, the slope of the curve along which the particle moves is

(A) $-\frac{2\sqrt{3}}{9}$ (B) $-\frac{\sqrt{3}}{2}$ (C) $\frac{2}{\sqrt{3}}$ (D) $-\frac{2\sqrt{3}}{3}$ (E) 2

Use the graph shown, sketched on [0, 7], for Questions 54–56.



54. From the graph it follows that

(A) f is discontinuous at $x = 4$
(B) f is decreasing for $4 < x < 7$
(C) f is constant for $0 < x < 4$
(D) $f(5) < f(0)$
(E) $f(2) < f(3)$

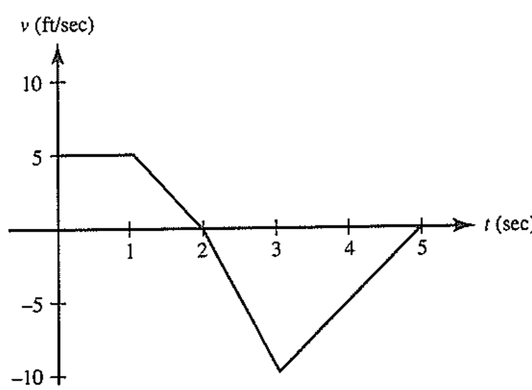
55. Which statement best describes f at $x = 5$?

(A) f has a root. (B) f has a maximum. (C) f has a minimum.
(D) The graph of f has a point of inflection. (E) f is discontinuous.

56. For which interval is the graph of f concave downward?

(A) (0,4) (B) (4,5) (C) (5,7) (D) (4,7) (E) none of these

Use the graph shown for Questions 57–63. It shows the velocity of an object moving along a straight line during the time interval $0 \leq t \leq 5$.



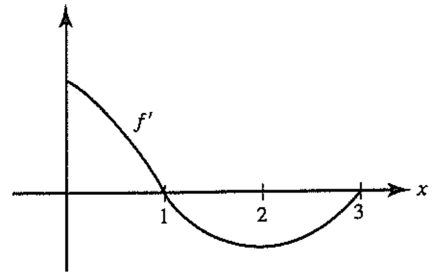
57. The object attains its maximum speed when $t =$

(A) 0 (B) 1 (C) 2 (D) 3 (E) 5

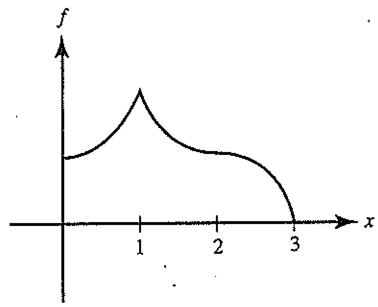
58. The speed of the object is increasing during the time interval

(A) (0,1) (B) (1,2) (C) (0,2) (D) (2,3) (E) (3,5)

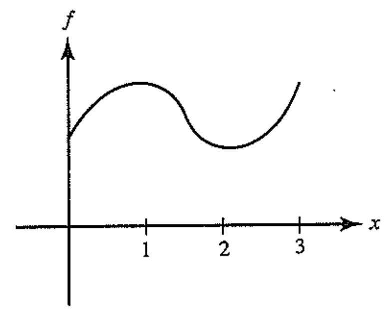
87. Given f' as graphed, which could be the graph of f?



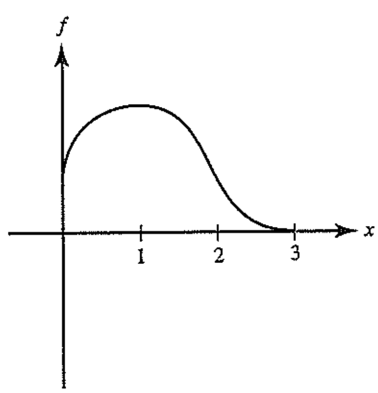
(A)



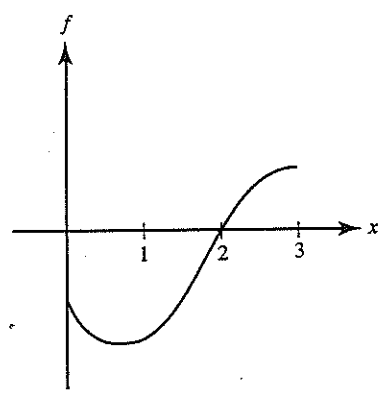
(B)



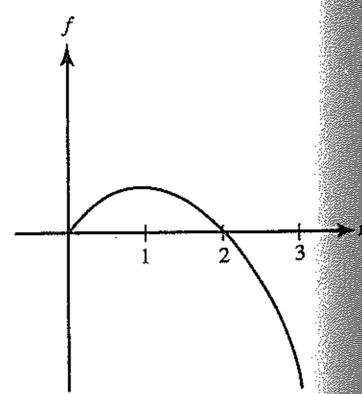
(C)



(D)



(E)



Use the following graph for Questions 88–90.